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ENVIRONMENTAL RESTORATION PROJECT

A Department of Energy
Environmental Cleanup Program

Environmental Restoration Project
Standard Operating Procedure

for:

Geodetic Surveys

Los Alamos
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Revision Log

Revision (Date)	*Prepared By*	*Description of Changes*	*Affected Pages*
R0 3/21/95	Richard Koch	New procedure	All
R1 11/13/01	Steven Reneau	Revised to follow format of QP-04.02 R3 and to make procedure consistent with current geodetic surveying in the ER Project	All

Standard Operating Procedure Title

Table of Contents

Geodetic Surveys

Note: Subcontractors may follow this standard operating procedure (SOP) for geodetic surveys or may use their own procedure(s) as long as the substitute meets the requirements prescribed by the Laboratory's LPR 308-00-00.1, Quality, and have been approved by the Environmental Restoration (ER) Project's Quality Program Project Leader (QPPL) before the commencement of the designated activities.

Note: ER Project personnel may produce paper copies of this procedure printed from the controlled-document electronic file located at http://erinternal.lanl.gov/home_links/Library_proc.shtml. However, it is their responsibility to ensure that they are trained to and utilizing the current version of this procedure. The author may be contacted if text is unclear.

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the process for coordinating, conducting, and evaluating geodetic surveys for the Los Alamos National Laboratory (Laboratory) ER Project.

2.0 SCOPE

This SOP is a manadatory document and all **ER Project participants** shall implement it when coordinating, conducting, and evaluating geodetic surveys for the ER Project

Note: Subcontractors performing work under the ER Project's quality program shall follow this SOP for coordinating, conducting, and evaluating geodetic surveys, or may use their own procedure(s) as long as the substitute meets the requirements prescribed by the ER Project Quality Management Plan, and is approved by the ER Project's Quality Program Project Leader (QPPL) before the commencement of the designated activities.

3.0 TRAINING

The **Field Team Leader** (FTL) is responsible for ensuring that field team members who coordinate, conduct, or evaluate geodetic surveys for the ER Project are familiar with the objectives and requirements of the intended surveying activities and have sufficient relevant experience to conduct this work. In addition, all relevant field team members must document at http://erinternal.lanl.gov/Training/Trainingmain.shtml that they have read and understand this procedure in accordance with QP-2.2.

Note: This SOP is to be used in conjunction with an approved SSHASP. Also, consult the SSHASP for information on and use of all PPE.

4.0 DEFINITIONS

Note: A glossary of definitions can be located on the ER Project internal homepage http://erinternal.lanl.gov/WritingGuide.shtml.

4.1 *Geodetic Survey*—A survey that determines the precise location of points on the earth's surface.

4.2 *Survey Coordinates*—Coordinates that are expressed in a Cartesian system, which includes x, y, and z components (easting, northing, and elevation, respectivey).

4.3 *Site-Specific Health and Safety Plan (SSHASP)*—A health and safety plan that is specific to a site or ER-related field activity that has been approved by applicable ER Project health and safety representatives. This document contains information specific to the project including scope of work, relevant history, descriptions of hazards by activity associated with the project site(s), and techniques for exposure mitigation (e.g., personal protective equipment [PPE]) and hazard mitigation.

5.0 BACKGROUND AND PRECAUTIONS

This SOP is focused on obtaining survey data of sufficient nature and accuracy for use in ER Project investigations. All survey data must utilize the 1983 North American Datum (NAD 83) system to be allow direct input into the Facility for Information Management Analysis and Display (FIMAD) Geographic Information System (GIS). Survey coordinates must be reported in established New Mexico state plane coordinates and elevations, which are expressed in units of feet.

Acceptable survey data can be obtained with a variety of methods (e.g., standard land surveying methods utilizing a total station, or, alternatively, a high precision global positioning system [GPS]), although any method can also result in unacceptable data due to human error or other causes (e.g. imprecise GPS measurements). It is the responsibility of the FTL to ensure that survey data are of sufficient quality for use in the investigation.

This SOP assumes that personnel collecting survey data have sufficient experience in survey methods to obtain data of adequate quality for use in the ER Project. It is the responsibility of the FTL to ensure that survey personnel have such qualifications. Personnel with sufficient experience may include licensed professional surveyors or earth scientists or other professionals who have field experience with the use of total stations, GPS units, or other surveying equipment.

Note: This SOP is to be used in conjunction with an approved SSHASP. Also, consult the SSHASP for information on and use of all PPE.

6.0 RESPONSIBLE PERSONNEL

The following personnel are responsible for activities identified in this procedure.

6.1 ER Project Personnel

6.2 Field Team Leader (FTL)

6.3 Focus Area Data Steward

6.4 Focus Area Team Leader (FATL)

6.5 Surveyor

7.0 EQUIPMENT

Descriptions of commonly used pieces of equipment, their advantages, and their limitations are listed below.

7.1 *Total Station*—A computerized theodelite that measures angles and distances to a prism located on a rod and that records these data electronically. When the total station is accurately located in reference to control points with known coordinates, these data can be directly converted into NAD 83 coordinates. One limitation is that data obtained with a total station are subject to human error, requiring checks on the accuracy of the data.

7.2 *Global Positioning System (GPS)*—A system that obtains coordinates of the instrument by triangulating to a network of satellites. High precision differential GPS units can obtain centimeter scale accuracy under the right conditions, although lower precision data can also be obtained using GPS that are inadequate for most ER applications. GPS units are most effective in open areas where the instrument can communicate with multiple satellites. The use of GPS may be impractical in some areas where communication with satellites is more difficult, such as heavily forested areas or in deep narrow canyon bottoms.

8.0 PROCEDURE

Note: Deviations from SOPs are documented in accordance with QP-5.7, Notebook Documentation for Environmental Restoration Techncial Activities.

8.1 The FTL or a designated field team member (designee) determines the locations of sample locations, grid points, control points, or other sites that require surveying, and provide this information to the individuals who will be performing the survey. Communications with the surveyors may include

some combination of field visits, written information (e.g., lists of location IDs), and or maps.

8.2 The surveyor surveys the designated points using surveying methods that provide acceptable accuracy for the purposes of the investigation and provides the coordinates of the points to the FTL or designee. Coordinates should be provided electronically in a format that can be easily input into FIMAD.

Note: An accuracy of 0.1 foot horizontally is fully sufficent for most ER applications, and a lower degree of accuracy may be acceptable for many purposes. The elevation (vertical coordinate) is not required for many tasks (e.g., plotting a sample location on a map), and in these cases the vertical accuracy is irrelevant. The required level of accuracy needs to be determined by the FTL or designee.

8.3 The FTL or designee conducts a QA/QC check of the surveyed points by having them plotted on FIMAD maps and/or orthophotos and comparing their locations with preexisting surveyed points and/or other features (e.g., roads, buildings, stream channels) and/or with each other. The survey data should be both internally consistent (all surveyed points in correct location relative to each other) and consistent with other features. If an error or omission is encountered, the FTL or designee contacts the surveyor to check the survey data and/or to repeat the survey or portions thereof. The FTL or designee will document completion of the QA/QC check in a field notebook.

8.4 When the survey data are considered acceptable, the FTL or designee transfers coordinates of sample locations to the Focus Area data steward for incorporation into the ER database.

Note: Some survey data, such as temporary control points used during field investigations, do not need to be captured in an archival database.

9.0 REFERENCES

The following documents are cited within this procedure.

QP-2.2, Personnel Orientation and Training

QP-4.4, Record Transmittal to the Records Processing Facility

QP-5.7, Notebook Documentation for Environmental Restoration Techncial Activities

10.0 RECORDS

The Focus Area Team Leader (FATL) or designee is responsible for submitting the following records (processed in accordance with QP-4.4, Record Transmittal to the Records Processing Facility) to the Records Processing Facility.

10.1 A report that includes maps with surveyed sample locations.

11.0 ATTACHMENTS

None